



Environmental Analysis Program

Pomona College
Biogeochemistry Laboratory

SOP-F306

Wetland Hydrology Monitoring

Standard Operating Procedure

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1. Purpose

This procedure describes field methods for monitoring wetland hydrology, including measurement of water table depth, surface inundation extent, and hydroperiod documentation. Hydrology is the primary driver of wetland ecosystem structure and function: it controls soil saturation, redox

chemistry, plant community composition, and jurisdictional wetland status under the Clean Water Act (Mitsch & Gosselink, 2015; US Army Corps of Engineers, 1987).

Wetland hydrology monitoring supports baseline characterization, impact assessment, restoration monitoring, and regulatory compliance (e.g., Army Corps of Engineers wetland delineation criteria).

2. Scope

- **Applies to:** Freshwater wetlands (marshes, swamps, riparian wetlands, vernal pools, constructed wetlands) at EA Program field sites. Methods include manual water-level measurements in monitoring wells and piezometers, crest gauges, staff gauges, and automated water level loggers.
- **Does not apply to:** Tidal wetland hydrology (requires tide- corrected methods); stream stage-discharge relationships (see [SOP-F301](#)); groundwater monitoring in non-wetland wells (see [SOP-F303](#))
- **Location:** All EA Program wetland field sites

3. Responsibilities

Role	Responsibility
PI / Field Lead	Approve monitoring design, coordinate permits
Trained Personnel	Install equipment, collect data per this SOP
New Students	Complete training before independent use

4. Definitions

- **Hydroperiod:** The duration and timing of surface water or near-surface saturation in a wetland during a given year; the most important determinant of wetland vegetation, soil development, and biogeochemical function.
- **Hydric soil:** A soil that formed under conditions of saturation, flooding, or ponding long enough to develop anaerobic conditions in the upper part; identified by redoximorphic features and low-chroma colors; a required criterion for jurisdictional wetland delineation.
- **Ordinary high water mark (OHWM):** The line on the shore established by the fluctuations of water leaving physical characteristics such as a clear, natural line impressed on the bank, shelving, destruction of terrestrial vegetation, or presence of litter and debris; used to define the lateral extent of jurisdictional waters.
- **Piezometer:** A small-diameter tube installed in the soil with a screened section at a defined depth; measures hydraulic head at that depth; used to determine the direction and magnitude of groundwater flow and to detect perched water tables.
- **Redox potential (Eh):** A measure of the oxidizing or reducing conditions in soil or water, expressed in millivolts; positive values indicate oxidizing conditions; negative values indicate reducing conditions under which Fe, Mn, and sulfate are reduced and redoximorphic features develop.

- **Staff gauge:** A graduated rod installed vertically in a water body or wetland to allow direct visual reading of water surface elevation; used to record surface water stage and to relate water level logger records to a local datum.
- **Water table:** The upper surface of the zone of saturation in the soil; measured as the depth to free-standing water in a well or piezometer; fluctuates seasonally and in response to precipitation events.
- **Wetland indicator status:** A US Army Corps of Engineers classification of plant species by their probability of occurrence in wetlands: OBL (obligate wetland), FACW (facultative wetland), FAC (facultative), FACU (facultative upland), UPL (upland); used in vegetation-based wetland delineation.

5. Safety and Hazards

Hazards

- **Physical:** Wetland substrates are unstable; risk of sinking in soft muck, tripping on submerged debris, or falling. Standing water may conceal holes and channels.
- **Biological:** Mosquitoes (disease vectors), ticks, venomous snakes, poison oak/ivy, and waterborne pathogens. Avoid direct skin contact with standing water.
- **Environmental:** Heat stress in summer; hypothermia in winter. Wetlands offer little shade.

5.1. Required PPE

- ☐ Rubber boots or chest waders
- ☐ Nitrile gloves
- ☐ Long sleeves and pants (tick and mosquito protection)
- ☐ Insect repellent (DEET or picaridin)
- ☐ Sun protection (hat, sunscreen)
- ☐ Personal flotation device (if water depth exceeds knee level)

5.2. Emergency Procedures

Work in pairs. If a team member becomes stuck in soft substrate, distribute weight on a board or backpack and pull laterally rather than vertically. Refer to [SOP-F001 Field Safety](#).

6. Equipment and Materials

6.1. Manual Measurement

Item	Notes
Water level indicator (electric tape, e-line)	For measuring depth to water in wells and piezometers
Staff gauge (graduated, metric)	For measuring surface water stage
Crest gauge	Records peak water level between visits
Meter stick or folding rule	Backup; for shallow inundation depth
Field notebook and data sheets	Waterproof (Rite in the Rain)
GPS unit	Per SOP-F006
Camera	For photo-documenting site conditions

6.2. Automated Monitoring

Item	Notes
Pressure transducer water level logger (e.g., HOBO U20L, Solinst Levellogger, In-Situ Level TROLL)	Deployed in wells or stilling wells
Barometric pressure logger	Required for compensating non-vented transducers; install above the high water line at or near the site
PVC monitoring wells (2 in or 4 in diameter, slotted screen)	Installed per Section 6.1
Well caps and locks	To prevent tampering and wildlife entry
Well keys or locks	For secured installations
Laptop or shuttle for data download	With manufacturer software

7. Procedure

7.1. Monitoring Well Installation

Note

Well installation may require permits (e.g., well permits, Section 404 permits for work in wetlands). Confirm requirements with the PI before installation.

1. Select well locations based on the study design (e.g., transect from upland to wetland center, paired wells at different depths)
2. Auger a borehole to the target depth (typically 1–2 m for shallow water table monitoring)
3. Install a 2-inch or 4-inch PVC well with a slotted screen in the saturated zone and a solid riser above the ground surface
4. Backfill the annular space around the screen with clean silica sand; seal the upper portion with bentonite to prevent surface water infiltration along the well casing
5. Install a protective well cap; record the top-of-casing (TOC) elevation relative to a local benchmark using a survey level

6. Develop the well by surging and bailing to remove drilling mud and fine sediment. Allow the well to equilibrate for at least 24 hours before the first measurement.
7. Record the well construction details (total depth, screen interval, stick-up height, TOC elevation, GPS coordinates) on the well installation log

7.2. Manual Water Level Measurement

1. Remove the well cap. If the well is locked, note the time and condition of the lock.
2. Lower the water level indicator (e-line) slowly into the well. When the probe contacts the water surface, the indicator will sound or light up.
3. Read the depth to water from the top of casing (TOC) to the nearest 0.01 ft or 0.5 cm. Record this value.
4. Calculate the water table elevation:

$$\text{WTE} = \text{TOC elevation} - \text{depth to water}$$

5. If the water table is above the ground surface (artesian or flooded conditions), measure the height of water above the TOC or use a staff gauge for ponded water.
6. Record date, time, depth to water, and any observations (e.g., well condition, nearby disturbance, wildlife activity) in the field notebook.
7. Replace and secure the well cap.

7.3. Staff Gauge and Crest Gauge Reading

1. Read the water level on the staff gauge to the nearest 0.5 cm. Read at eye level to avoid parallax.
2. Record the reading, date, time, and any obstructions (debris on the gauge, algae).
3. For crest gauges: record the peak water mark left by granular cork or paint inside the gauge since the last visit. Reset the gauge per the manufacturer's instructions.

7.4. Automated Logger Deployment and Download

1. Program the logger for the desired recording interval (typically 15 minutes to 1 hour for wetland hydrology)
2. Deploy the logger in the well, suspended at a known depth below the TOC using a stainless steel cable or direct-read cable
3. Deploy a barometric logger above the expected high water line (for non-vented transducers)
4. Record the deployment details: logger serial number, deployment depth, start time, recording interval
5. On each visit, download data using the manufacturer's software. Take a manual water level measurement at the time of download for calibration verification.
6. Compensate pressure transducer data for barometric pressure changes using the barometric logger data. Most manufacturer software includes an automated compensation routine.

7.5. Inundation Mapping

1. During each visit, note the spatial extent of surface water or saturated soil at the site
2. Record the inundation boundary on a site map or using GPS waypoints
3. Photograph fixed photo points to document seasonal changes in inundation
4. Record the presence of wetland hydrology indicators (oxidized rhizospheres, water-stained leaves, drift lines, sediment deposits, water marks on trees) per the Army Corps of Engineers wetland delineation manual (US Army Corps of Engineers, 1987)

8. Quality Control

- Take a manual water level reading concurrent with every logger download to verify logger accuracy. If the manual reading and logger reading differ by more than 2 cm, troubleshoot the logger (drift, fouling, cable slip).
- Record duplicate manual readings at 10% of wells per visit (read, remove the tape, re-read). Duplicates should agree within 0.5 cm.
- Check e-line calibration against a measured standard (e.g., a surveyed depth) at least once per season.
- Maintain a well construction log with TOC elevations; re-survey TOC elevations annually or after ground disturbance (frost heave, animal activity, mowing).
- Archive raw logger files in the project data folder before any processing. Version-control all compensation and correction scripts per [SOP-L801](#).

9. Data Management

1. Enter manual water level data into the project database within 48 hours of collection
2. Download, compensate, and archive logger data within 7 days of retrieval
3. Convert all water level data to a common datum (e.g., NAVD88 or a local benchmark) before analysis
4. Flag and document any data gaps, logger malfunctions, or well damage

10. References

Mitsch, W. J., & Gosselink, J. G. (2015). *Wetlands* (5th ed.). John Wiley & Sons.

US Army Corps of Engineers. (1987). *Corps of engineers wetlands delineation manual* (Technical Report Y-87-1). Waterways Experiment Station, US Army Corps of Engineers. <https://www.frl.usace.army.mil/Portals/64/docs/regulatory/Wetland-Delineation-Manual.pdf>

11. Related SOPs

SOP	Title	Relationship
F001	Field Safety	Required prerequisite

SOP	Title	Relationship
F006	GPS and Site Navigation	Well and gauge locations
F200	Eureka Manta2 Multiprobe	Water quality at wetland sites
F301	Stream Discharge	Surface water flow context
F303	Groundwater Sampling	Well sampling companion
F400	Soil Sampling	Wetland soil characterization

12. Training Record

Before performing wetland hydrology monitoring independently, personnel must:

1. Read this SOP and [SOP-F001](#) in full
2. Observe a trained operator demonstrate manual water level measurement and logger download at an active monitoring site
3. Practice using the water level indicator (e-line) under supervision and demonstrate agreement within 0.5 cm on duplicate readings
4. Demonstrate competence in logger programming and data download
5. Be signed off by the PI or field lead